

Fig.1

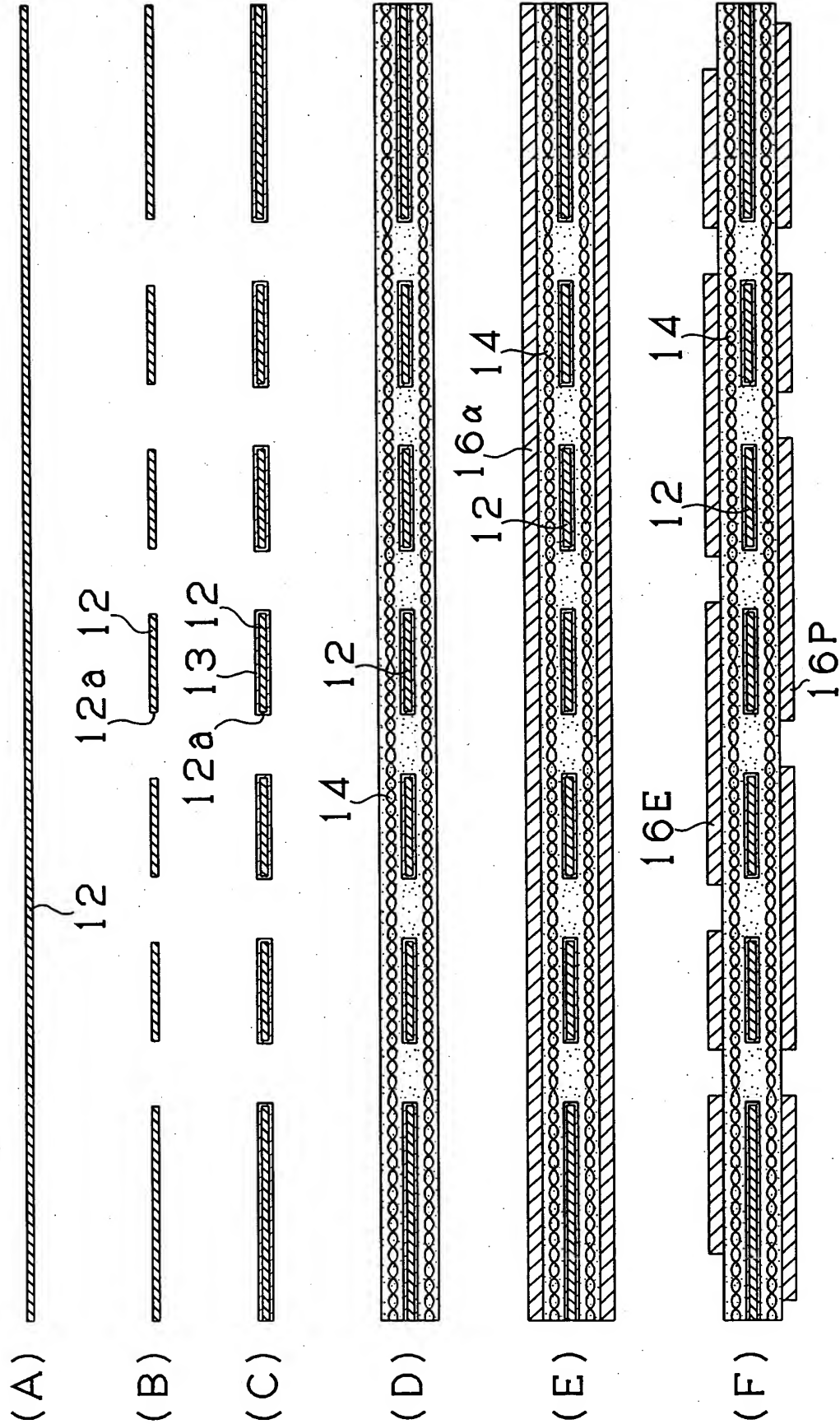
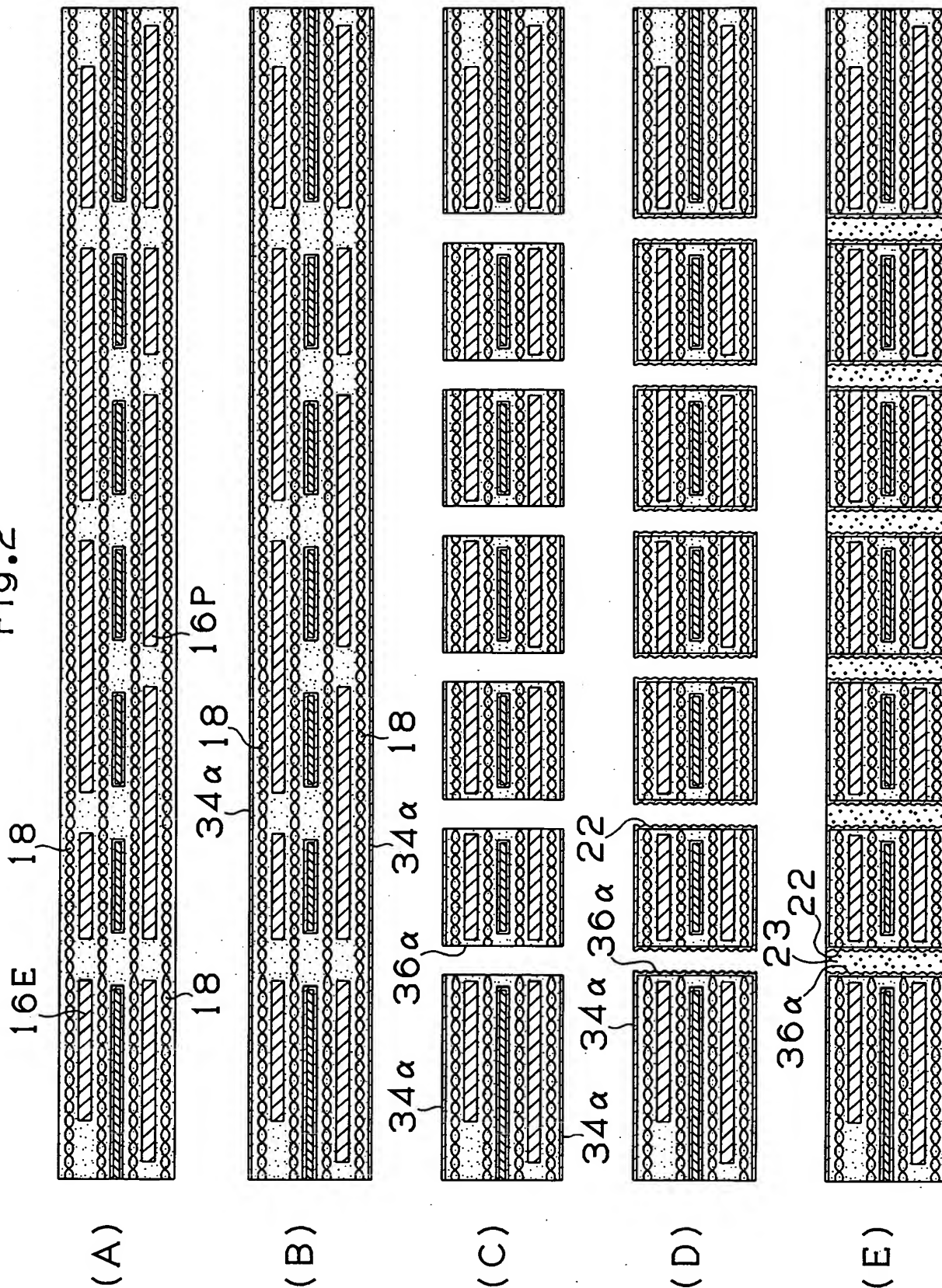


Fig.2

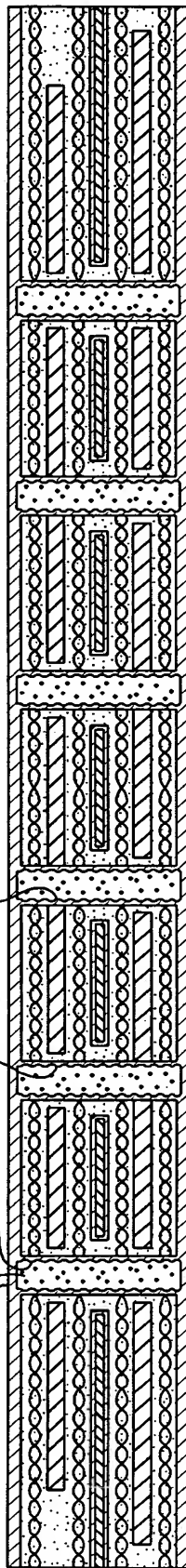


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Fig. 3

(A)

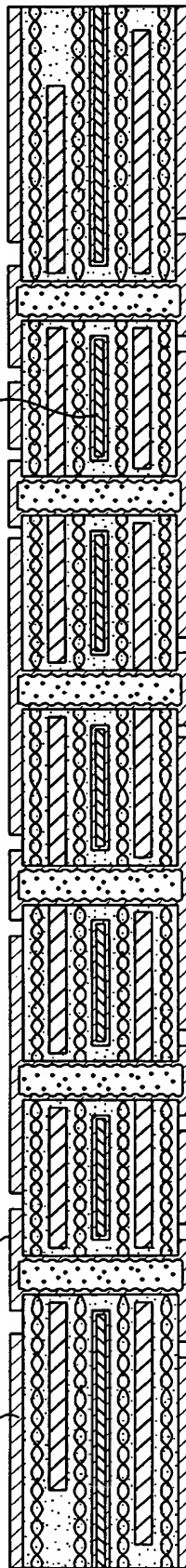
25 23 36S 36P 36E



(B)

30

34P 34



(C)

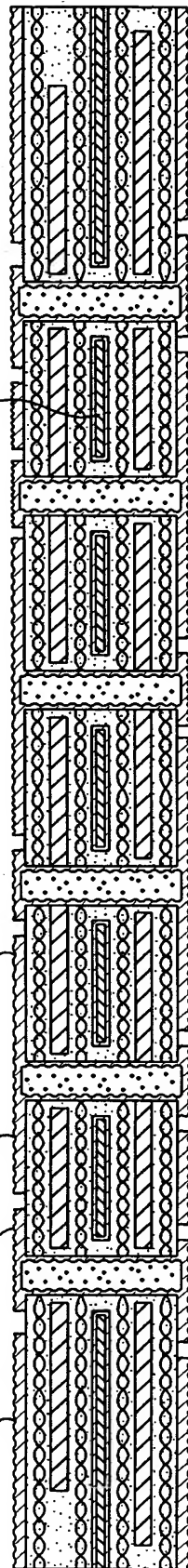
30

34E

34

34P 34 34B

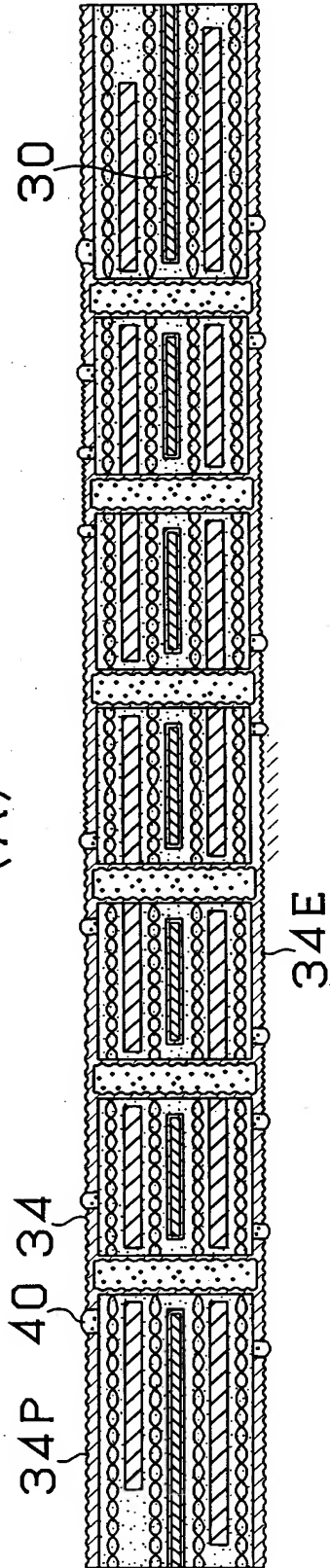
34P



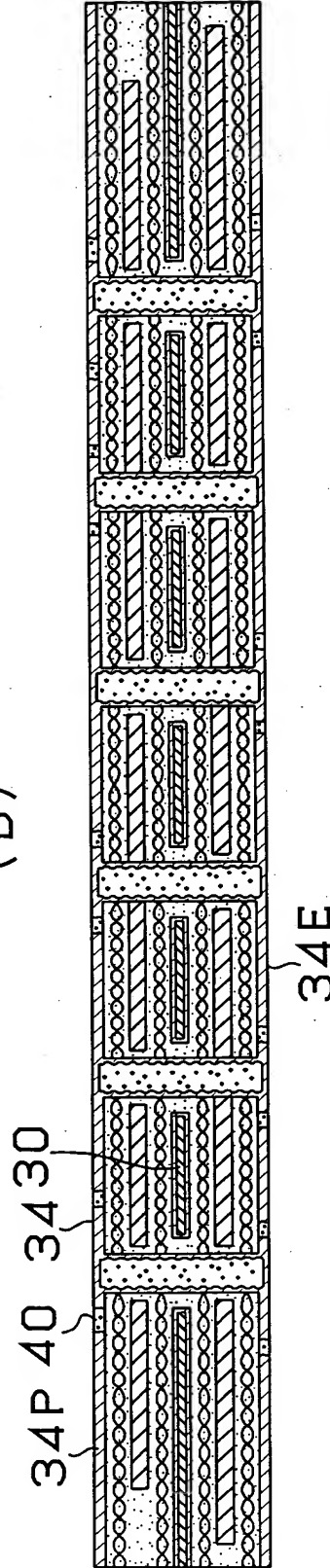
34E

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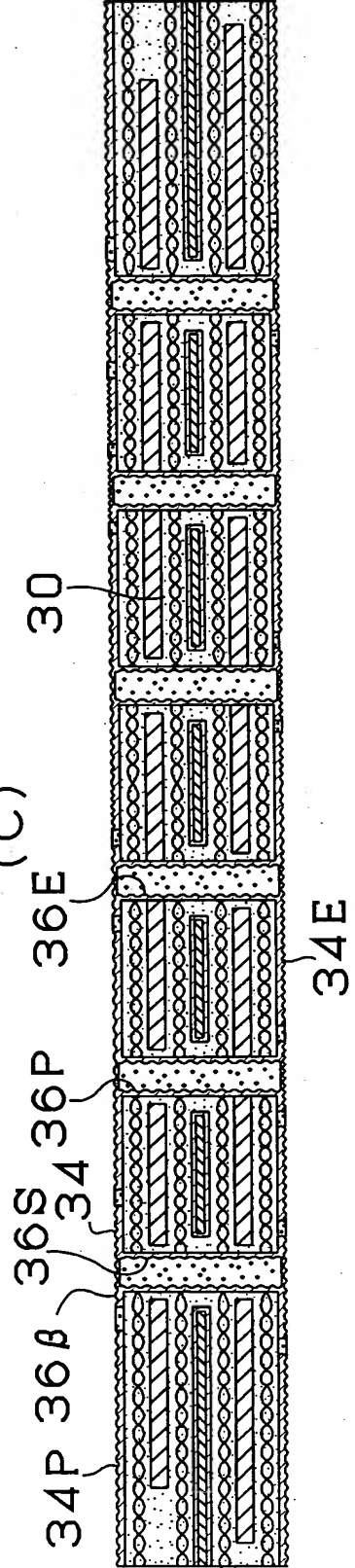
Fig. 4
(A)



(B)



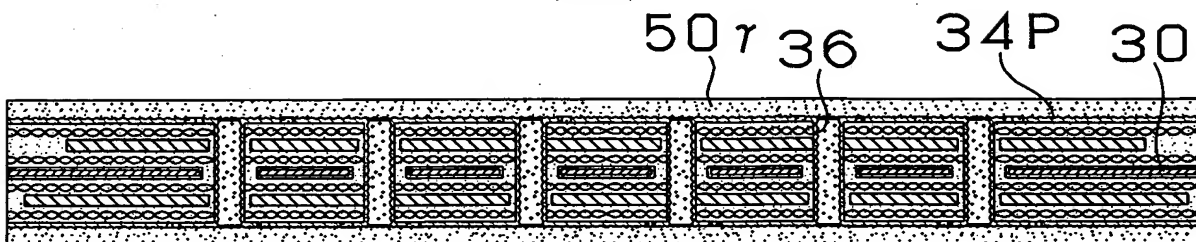
(C)



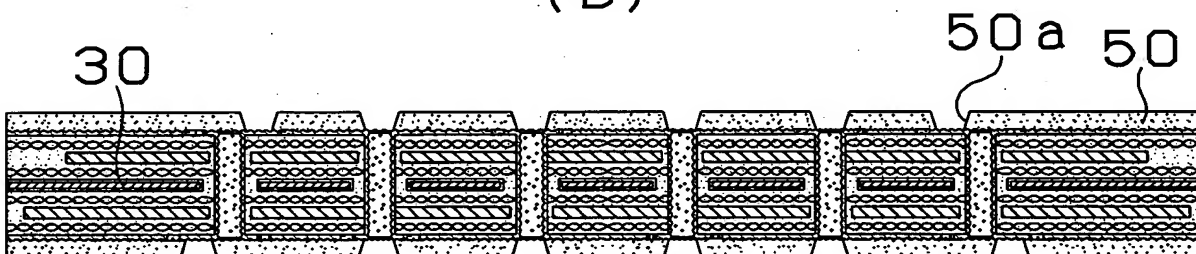
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Fig. 5

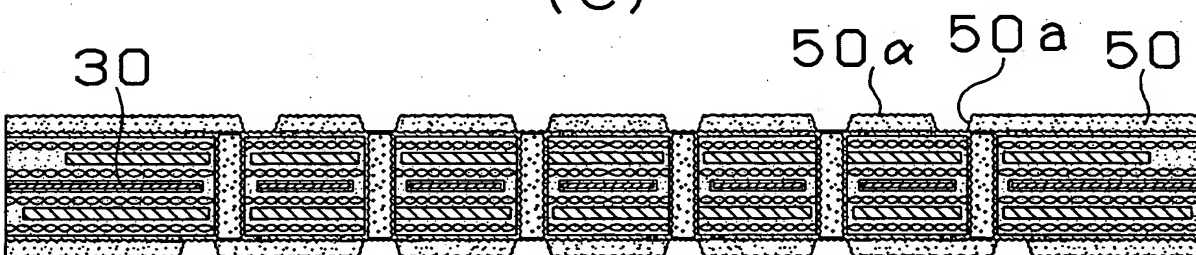
(A)



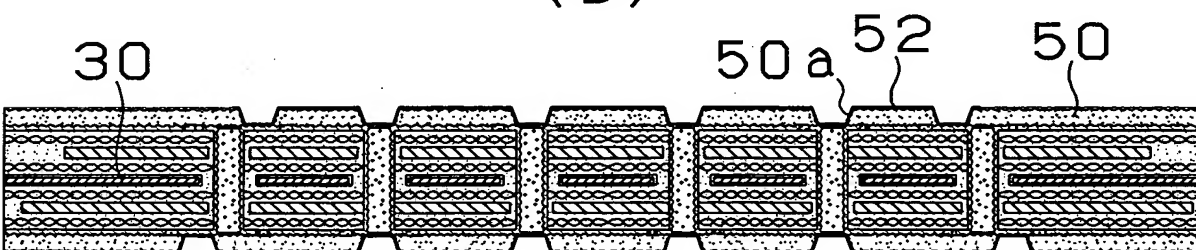
(B)



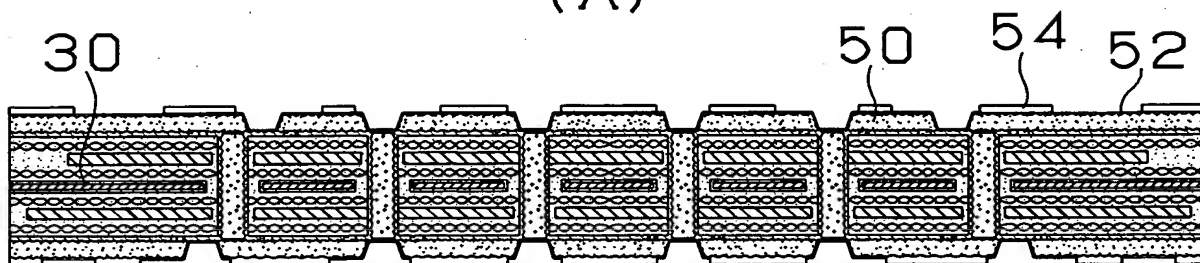
(C)



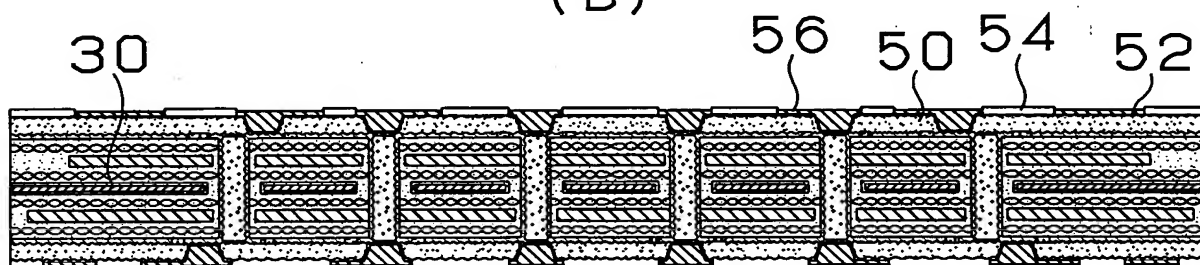
(D)



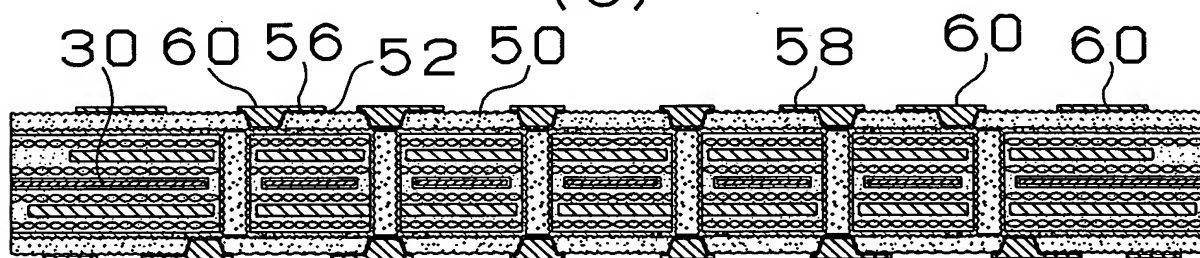
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Fig.6
(A)



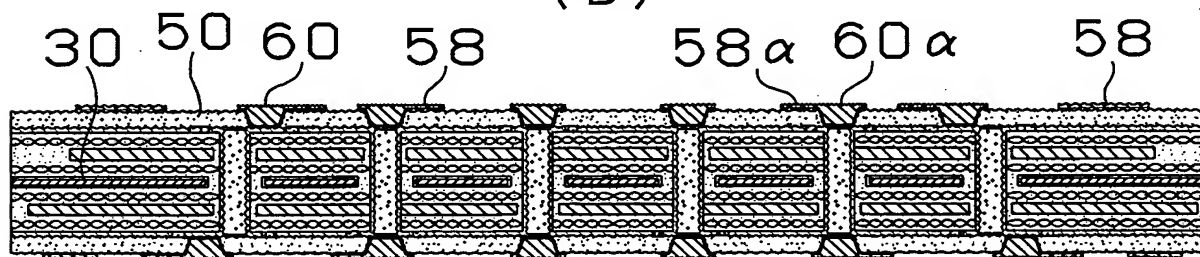
(B)



(C)



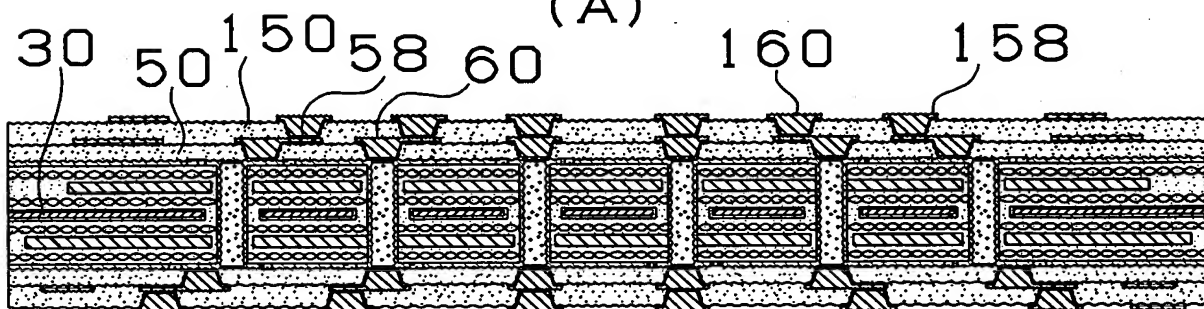
(D)



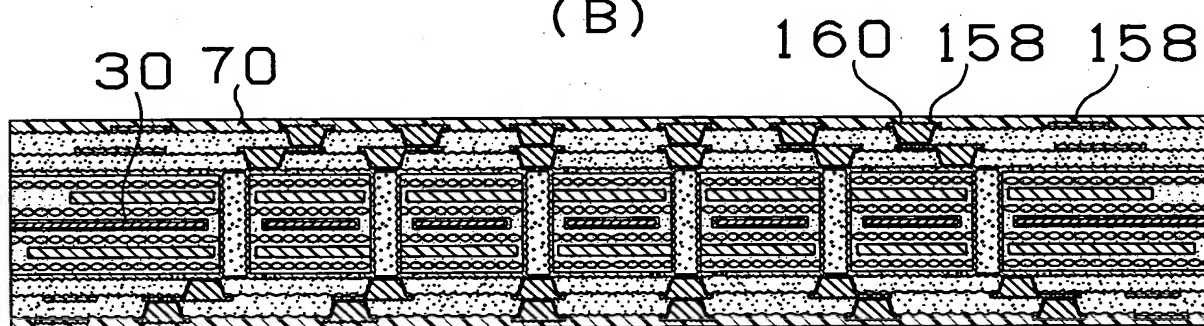
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Fig. 7

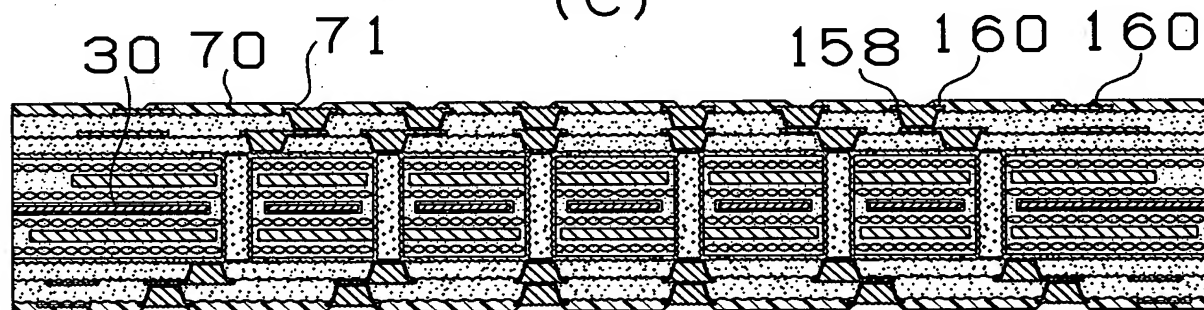
(A)



(B)



(C)



(D)

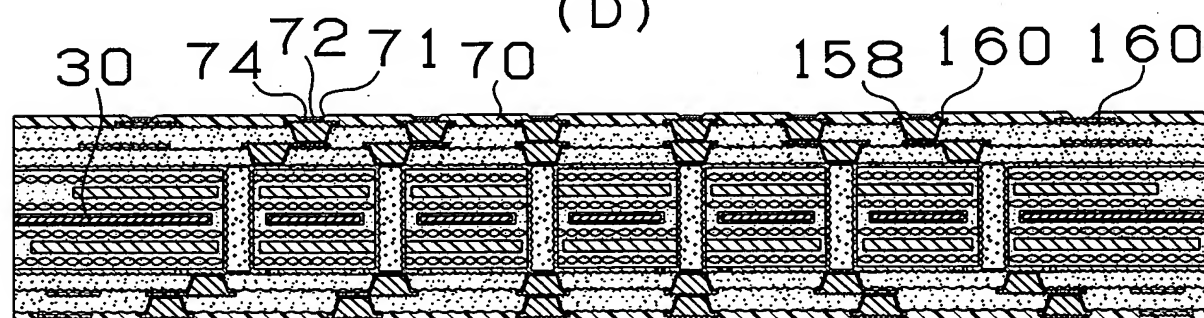
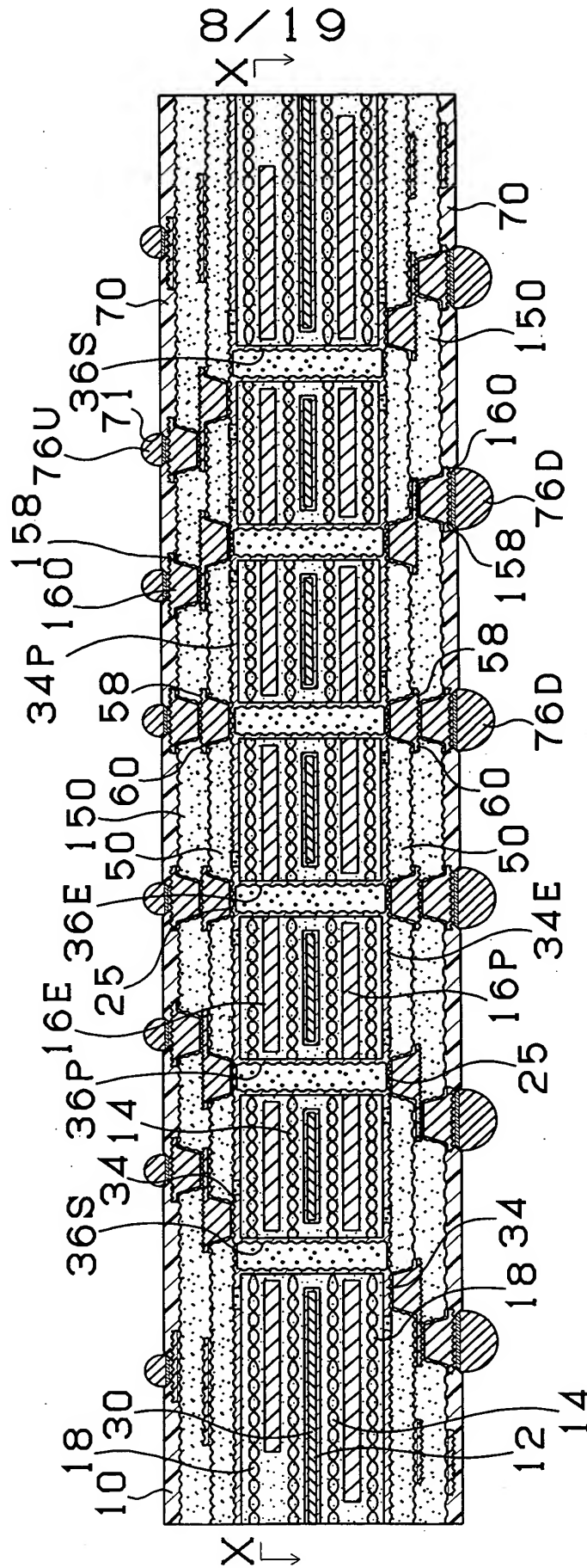
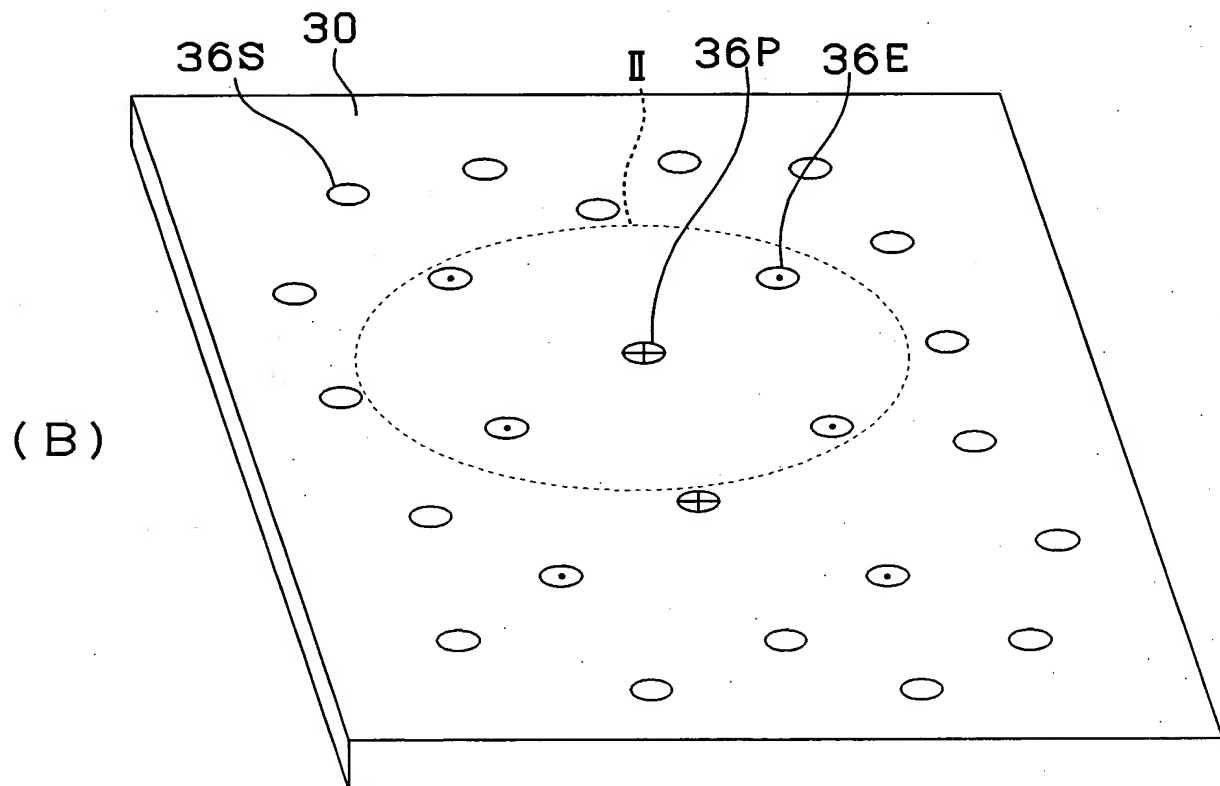
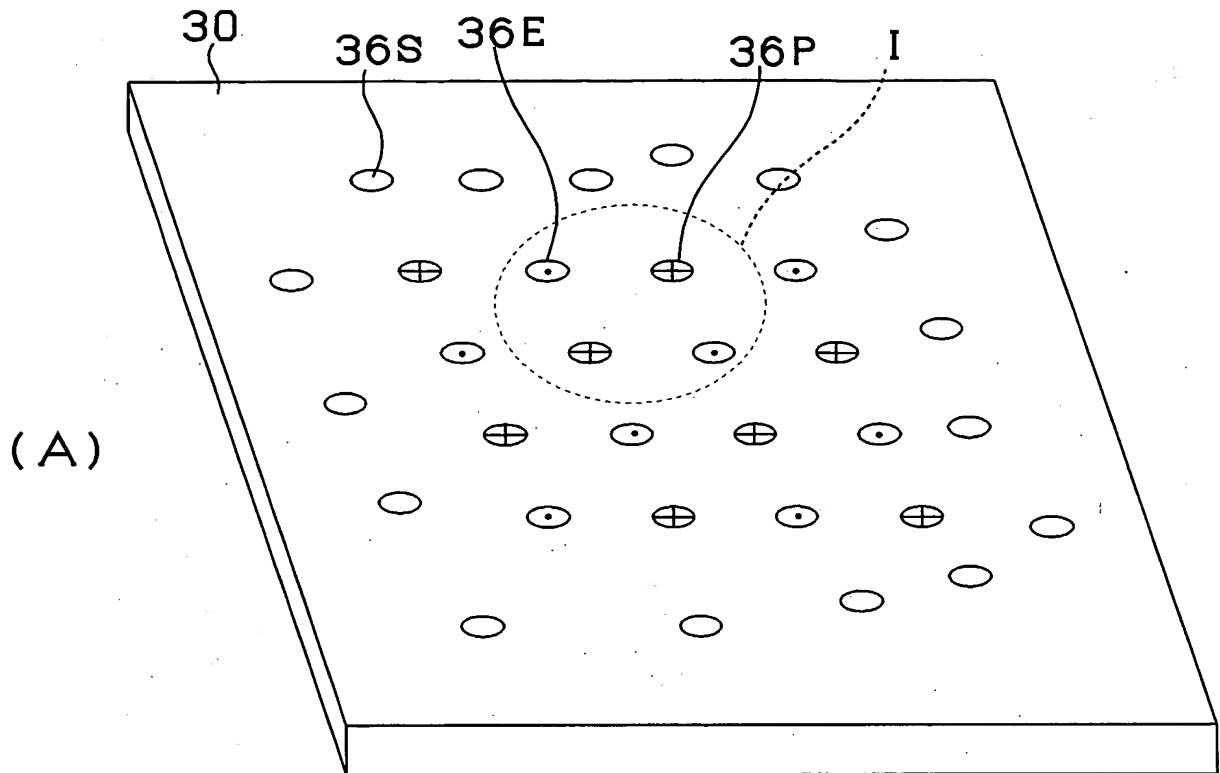


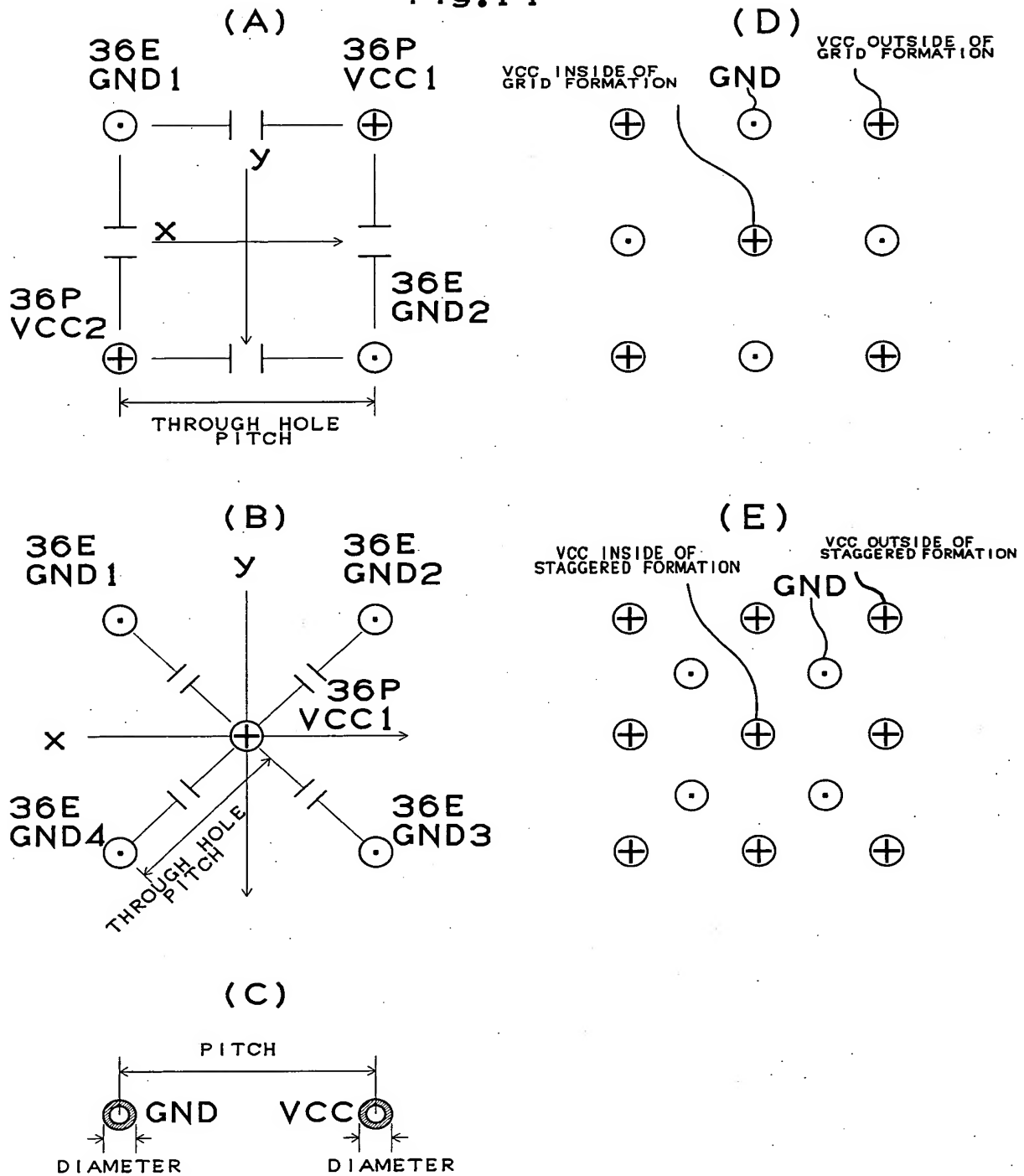
Fig. 8



This diagram shows a cross-sectional view of a multi-layered substrate assembly. The assembly consists of a top layer (90) and a bottom layer (94), both of which are divided into segments (96S, 96E, 96P, 96D) by vertical dividers (96S, 96E, 96P, 96D). The top layer (90) is further divided into segments (92S, 92E, 92P, 92U) by vertical dividers (92S, 92E, 92P, 92U). The bottom layer (94) is further divided into segments (96S, 96E, 96P, 96D) by vertical dividers (96S, 96E, 96P, 96D). The assembly is shown in a cross-sectional view, with the layers and dividers clearly visible. The labels 36S, 36P, 36E, 36U, 90, 92S, 92E, 92P, 92U, 94, 96S, 96E, 96P, 96D are used to identify the various components and segments of the assembly.

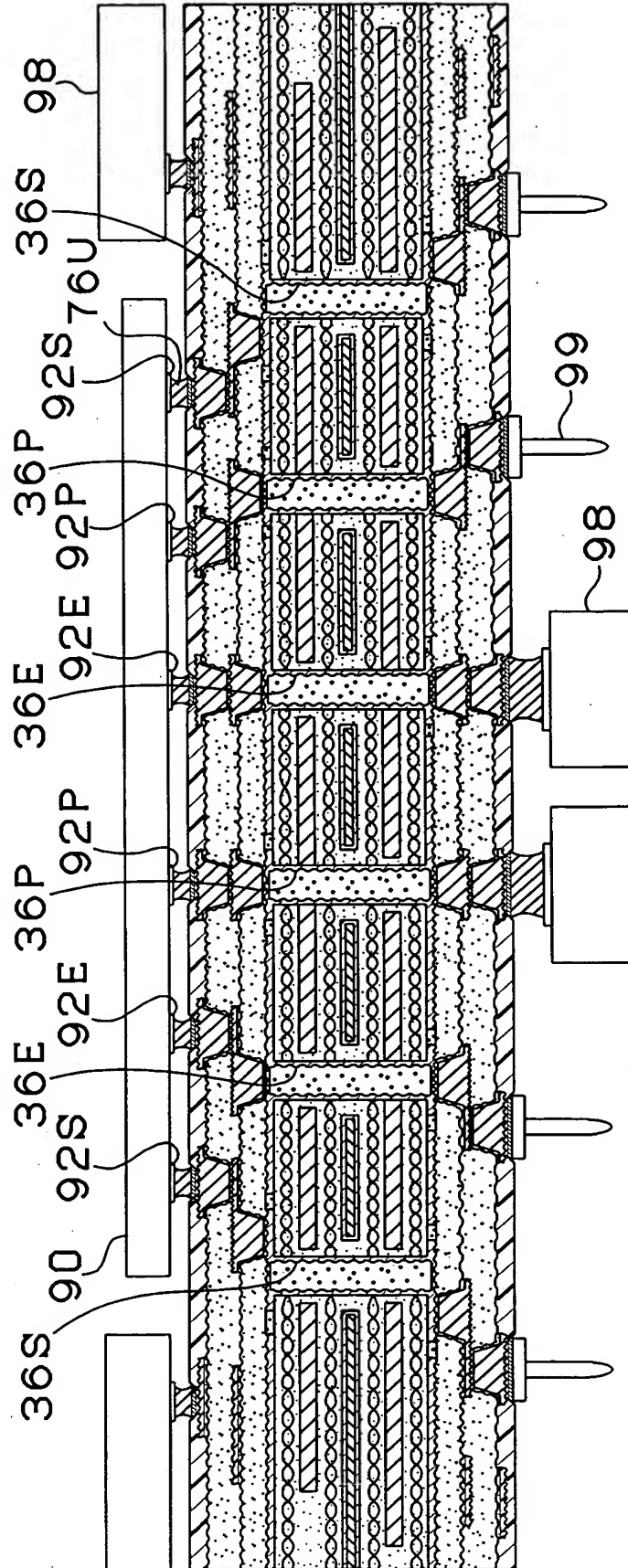
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Fig.10



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Fig. 11

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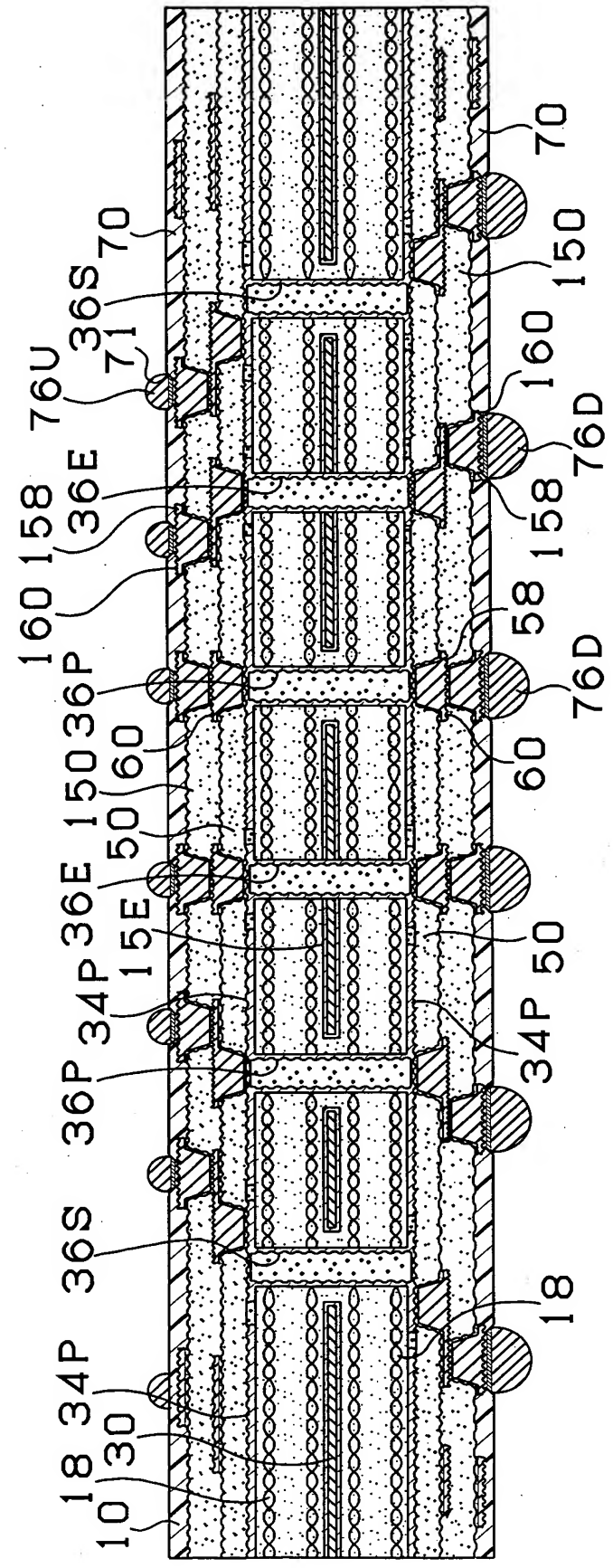
Fig.12



This cross-sectional view illustrates a multi-layered structure. The top layer is labeled 18. Below it is a layer 10, which contains a series of horizontal channels or grooves. These channels are filled with a material having a cross-hatched pattern, labeled 30. The walls of these channels are labeled 34. The bottom surface of the 10 layer is labeled 36S. Below the 10 layer is a layer 50, which contains a series of horizontal channels or grooves. These channels are filled with a material having a cross-hatched pattern, labeled 60. The walls of these channels are labeled 58. The bottom surface of the 50 layer is labeled 52. Below the 50 layer is a layer 150, which contains a series of horizontal channels or grooves. These channels are filled with a material having a cross-hatched pattern, labeled 160. The walls of these channels are labeled 158. The bottom surface of the 150 layer is labeled 152. The entire structure is shown within a frame labeled 70. Other labels include 36E, 36P, 36S, 34, 50, 58, 60, 150, 158, 160, 18, 30, and 76U.

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Fig. 14



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Fig. 15

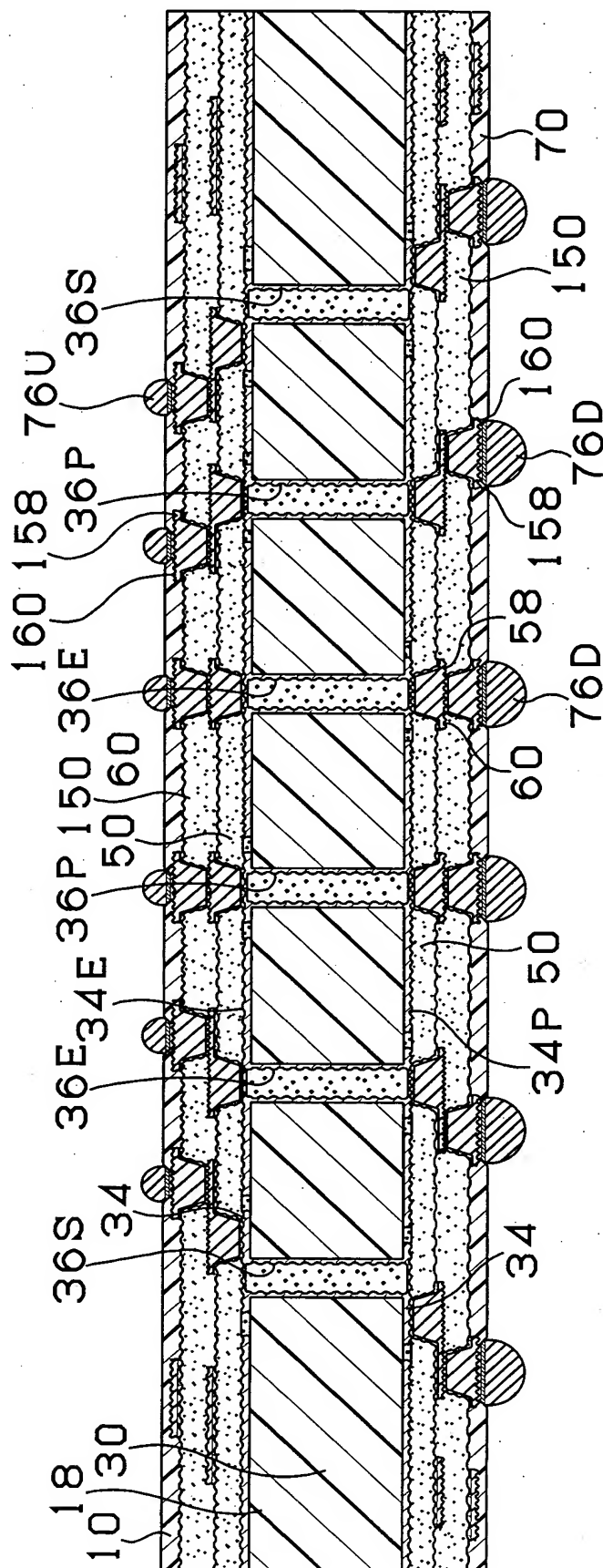


Fig. 16

THROUGH HOLE PITCH (μm)	THROUGH HOLE DIAMETER (μm)	THICKNESS OF CORE SUBSTRATE (μm)	STAGGERED FORMATION (THICK COPPER)	GRID FORMATION	RANDOM FORMATION	FOURTH REFERENCE EXAMPLE
			LOOP INDUCTANCE (pH)	LOOP INDUCTANCE (pH)	LOOP INDUCTANCE (pH)	LOOP INDUCTANCE (pH)
650	450	600	93	84	115	
600	400	600	87	75	109	88
550	350	600	73	59	100	75
500	300	600	73	56	95	75
475	275	600	63	57	90	65
450	250	600	59	55	85	62
425	225	600	58	55	85	60
400	200	600	59	55	—	60
80	50	600	55	50	90	57
50	25	600	63	60	—	

NOTE: A DIFFERENCE BETWEEN FOURTH REFERENCE EXAMPLE AND GRID FORMATION (THICK COPPER) IS JUST A SUM OF THICKNESSES OF CONDUCTIVE LAYERS IN MULTI-LAYER CORE SUBSTRATE.

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Fig. 17
(A)

THROUGH HOEL PITCH (μm)	STAGGERED FORMATION (THICK COPPER)		GRID FORMATION (THICK COPPER)	
	CRACK IN INSULATING LAYER	RESULT OF CONDUCTIVITY TEST	CRACK IN INSULATING LAYER	RESULT OF CONDUCTIVITY TEST
650	○	○	○	○
600	○	○	○	○
500	○	○	○	○
400	○	○	○	○
80	○	○	○	○
50	×	×	×	×

CRACK IN INSULATING LAYER : ○ NO CRACK × CRACK

RESULT OF CONDUCTIVITY TEST : ○ NO ABNORMALITY IN RESISTANCE
× ABNORMALITY IN RESISTANCE

(B)

THROUGH HOEL PITCH (μm)	STAGGERED FORMATION	GRID FORMATION
	LOOP INDUCTANCE (pH)	LOOP INDUCTANCE (pH)
650	93	84
600	87	75
550	73	60
500	63	56
475	63	57
450	59	55
425	58	54
400	55	52
350	54	50
300	54	50
200	53	50
100	54	49
75	54	49
60	55	50
50	63	60

Fig. 18

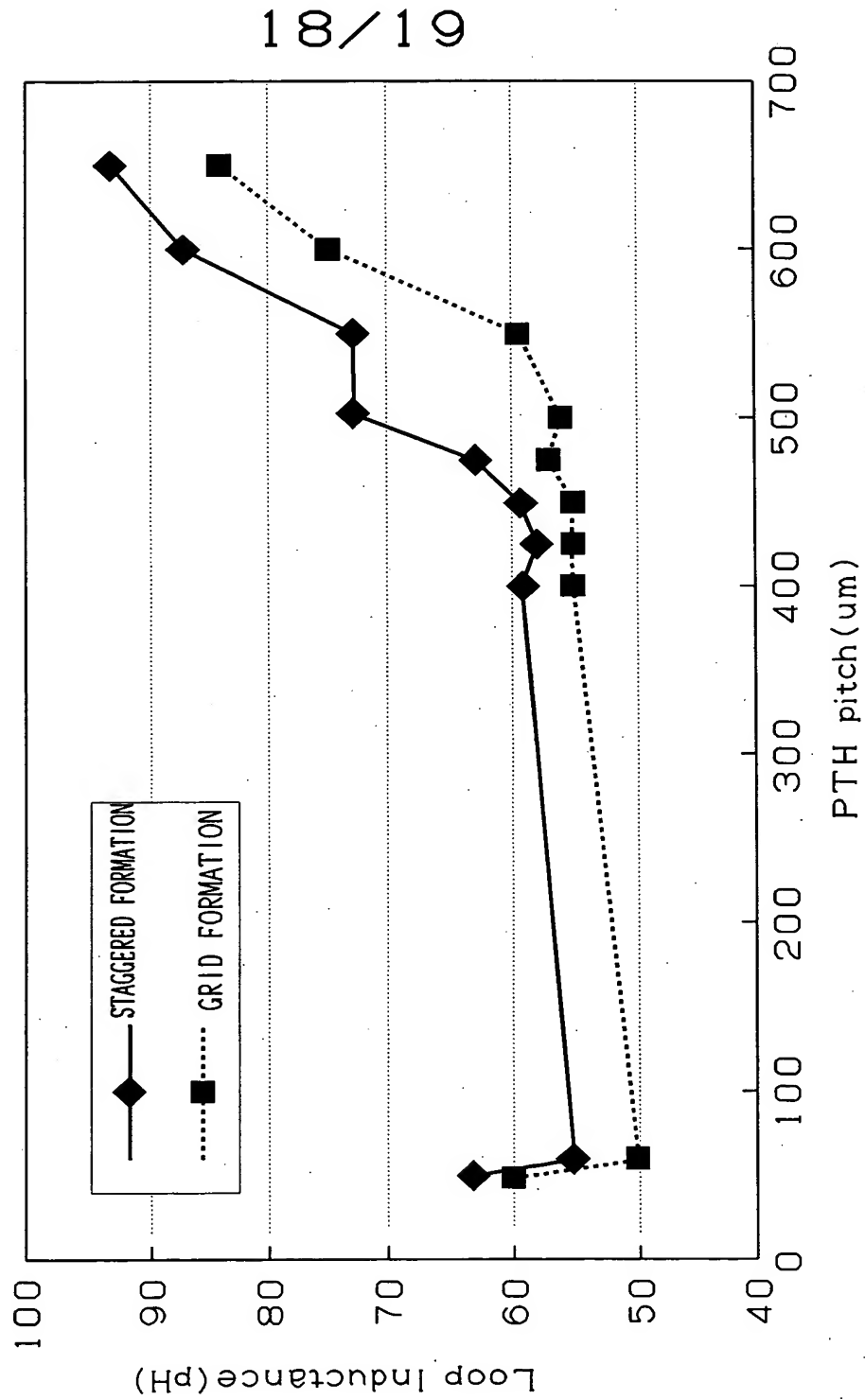
Core thickness = 600 μ m, PTH wall to wall space = 200 μ m

Fig. 19
RATIO OF CORE POWER LAYER

